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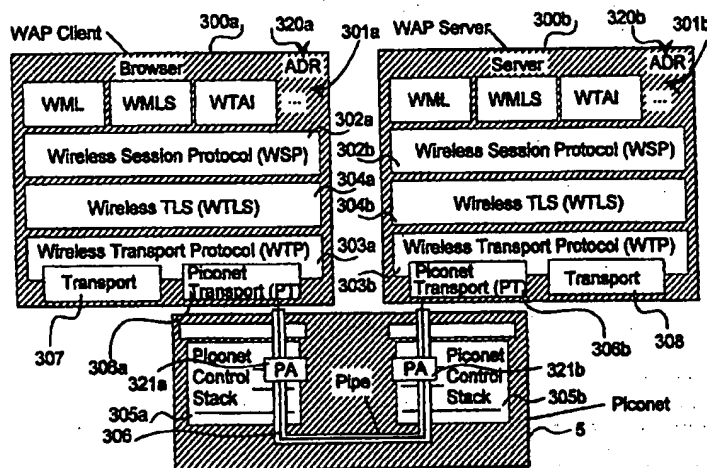
(57) Abstract

The invention relates to a method for setting up a data transmission connection which is formed for transmitting information between
at least a first communication device (1, 6–15, 300a, 300b, 400, 401) and a second communication device (1, 6–15, 300a, 300b, 400, 401),
in which method, for at least the first communication device (1, 6–15, 300a, 300b, 400, 401), a network address (321a, 321b) is selected
that is advantageously used for identifying the first communication device (1, 6–15, 300a, 300b, 400, 401). In the method according to
the invention, for at least one service of at least the first communication device (1, 6–15, 300a, 300b, 400, 401), an address information
(320a, 320b) is formed, which is advantageously used for identifying the service, and between the network address (321a, 321b) of the first
communication device (1, 6–15, 300a, 300b, 400, 401) and the address information (320a, 320b) of the service, a correspondence is arranged
for transferring information between the first communication device (1, 6–15, 300a, 300b, 400, 401) and the second communication device
(1, 6–15, 300a, 300b, 400, 401).

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METHOD AND DEVICE FOR SETTING UP A DATA TRANSMISSION CONNECTION

The present invention relates to a method for setting up a data trans-
5   mission connection as set forth in the preamble of claim 1. The inven-
tion relates also to a communication device as set forth in the preamble
of claim 10.

Local area networks usually consist of one or more server computers
10   as well as work stations and other peripheral devices communicating
with the same, such as printers and telecopiers. Communication in a lo-
cal area network is usually implemented in a wired manner, e.g. by
Ethernet cabling. Also wireless local area networks are known, where
data transmission is implemented by means of radio modems, thereby
15   reducing limitations relating to the placement of cabling, number of
connection points and their positioning in a wired local area network.

In local area networks, each peripheral device coupled to the local area
network has an address identifying the peripheral device, i.e. client,
20   whereby data is directed to this peripheral device. On the other hand,
information from the peripheral device is recognised by the server on
the basis of the address of the peripheral device. The peripheral device
and the server are equipped with a network adapter determined on the
basis of the physical structure of the local area network used at the
25   time, comprising means for receiving messages from the local area
network and for transmitting messages to the local area network.

Communication between different communication devices in local area
networks usually takes place as data transmission based on messages.
30   A message consists of address data and the actual information to be
transmitted. The address data is used for directing messages to the
correct device and, on the other hand, for identifying the device that
transmitted the message.

35   Wireless local area networks differ from wired ones primarily in that the
data transmission takes place by using a wireless communication
method, e.g. by means of radio waves, infrared or inductive data
transmission. In the operation, wireless local area networks are typically

star networks, *i.e.* information is transmitted between a server device and a peripheral device. Thus, the information to be transmitted between peripheral devices is conducted from the transmitting peripheral device to the server device which transmits the information further to
5   the receiving peripheral device.

In view of the operation of the local area network, the server device must know which peripheral devices are coupled to it at each time and what is the operating status of these peripheral devices. This can be
10 implemented   by   using,   for   example,   the   above-mentioned communication based on messages, whereby in connection with turning on and a possible change of state, the peripheral device transmits a message to the server device. The server device receives the message and examines the information content of the message.
15
A local area network is suitable for use *e.g.* in offices, whereby data is transmitted by using a compact data processor with a sufficient storage capacity. An example of such a portable device is the Nokia 9000 Communicator which can be used both as a mobile station and as a
20 data processor.

When using a wired communication network, also a portable data processor can be connected with a local area network by means of a network interface card, known as such and comprising means for setting
25 up a data transmission connection between the local area network and the portable device. To portable data processors, it is possible to connect different peripheral devices directly without the need of a local area network. The connection can also be based on wireless techniques, usually the infrared technique (IR). By coupling such a periph-
30 eral device to a portable data processor or the like, the data of the peripheral device in question in the data processor must be configured before the peripheral device can be used.

Data transmission between different communication devices, such as
35 servers and the clients of servers, in so-called piconets often takes place by means of short distance infrared (IR) data transmission, low power radio frequency (LPRF) data transmission, short distance radio frequency (SDRF) or inductive data transmission, whereby the data

transmission distances within the local area network consisting of a single piconet are typically only a few metres or dozens of metres.

In addition to local area networks, wide wireless communication net-
5   works are known, such as the public land mobile network (PLMN) which is a communication network based on a cellular system. As an example, one could mention the GSM-900 mobile communication network based on the GSM system (Global System for Mobile Communication). The cells of the communication network are distributed in a wide geo-
10   graphical area, and mobile stations (MS), such as mobile phones, which communicate with the communication network by means of base stations (BS), move from one cell to another. These mobile stations are separated from each other by means of a subscriber-specific identifica-tion code, whereby data transmission between two mobile stations,
15   such as data transfer or an audio call, is possible. The identification code used is *e.g.* the IMSI code (International Mobile Subscriber Num-ber). The communication network takes care of routing information between base stations and mobile services switching centres (MSC) by utilising registration data on the location of the mobile station in the
20   area of the cells of different base stations. Wireless communication networks include also GSM-1800, GSM-1900, PDC, CDMA, US-TDMA, IS-95, USDC (IS-136), iDEN (ESMR), DataTAC, and Mobitex.

For completing data transmission and processes related to data trans-
25   mission by data processors connected in a local area network, such as servers and clients, for example peripheral devices and possibly also wireless communication devices, there must be a collection of commu-nication rules available, determining the allowed messages and the op-eration of the communicating parties at different stages of the commu-
30   nication.

One such collection of communication rules is, in a known manner, a protocol, *i.e.* a practice whereby devices communicate with each other. For data transmission particularly in wireless communication networks,
35   a wireless application protocol (WAP) has been developed, and this will be used as an example in the following description. In a known manner, one version of the WAP application protocol is described *e.g.* in the publication WAP Architecture Draft Version 0.9 (1997-09) published in

the Internet network, describing *e.g.* the architecture of the WAP application protocol. By means of the WAP application protocol, it is possible to define a series of protocols at different levels, whereby it is possible to develop new services and devices for present and future wire-

5   less communication networks, *e.g.* mobile communication networks based on a digital cellular network. The WAP application protocol has been already developed *e.g.* for the short messaging service (SMS), unstructured supplementary service data (USSD), circuit switched data (CSD) and global packet radio system (GPRS) services of the GSM

10   network.

It is an aim of the present invention to achieve a system that, by means of a local area network, makes connections to data processors, such as servers, clients of the servers, or them both, possible for conducting

15   data transmission. The purpose of the invention is particularly to define a system for communication between a WAP server and a WAP client complying with the WAP application protocol in the area of a piconet utilising IR or SPRF services and utilising this piconet. The method of the invention is characterised in what will be presented in the preamble

20   of the appended claim 1. The communication device of the invention is characterised in what will be presented in the preamble of the appended claim 10.

The application layer of the architecture of the above-mentioned WAP

25   application protocol applies a defined wireless application environment (WAE) architecture. The different WAE applications of communication devices follow closely the protocol used in the Internet World Wide Web (WWW), where different applications and information is presented by means of standardised presentation formats which are browsed *e.g.*

30   by means of known WWW browsers. Thus, the servers and information in the WWW network are named according to a Uniform Resource Locator (URL) address complying with the Internet standard and independent of the location, and the information presentation format is one that is supported by the browser used, for example HyperText

35   Markup Language (HTML) or JavaScript.

It is an advantage of the method according to the invention to make it possible for the clients and servers of the local area network, the clients

and servers of another local area network, and particularly the clients and servers temporarily within the area of the local area network to communicate and to use different services. This results from the elimination of drawbacks caused by differences in the addresses and

5   addressing used in different communication networks. For example, the addressing of different nodes in a piconet differs from the addressing of nodes applying the WAP application protocol, whereby it is necessary to map the address used by the WAP application protocol to the corresponding address used by the piconet or to a temporary address

10   created by the piconet.

By means of said mapping, a correspondence is established between *e.g.* so-called logical addresses, such as URL addresses, used by WAP applications, and physical addresses of the network, *i.e.* network

15   addresses, used by the piconet. The network address is typically a non-standardised network-specific numerical code which is reserved for a device by the server for creating the network and which is only useful in the area of said network. A logical address indicates in this context also the address of clients, *i.e.* communication devices, which is typically

20   independent of the location and by means of which the communication device can be identified even in several different communication networks, in which the communication device is arranged to be operable. It should also be noticed that clients as well as services can be independent of the physical communication device, whereby the logical ad-

25   dress can only be used to indicate *e.g.* a service, irrespective of the communication device where it is located. The communication network must thus take care of the addressing also for finding the correct device.

30   The invention gives significant advantages to both local area networks of prior art, based on short distance data transmission, and mobile communication networks based on a cellular network. For example, by using piconets applying the method, it is possible to create entirely novel local area network systems and local area network services

35   which may include local access points *e.g.* to airport servers for inquiring flight schedules, retrieving airport services by means of pull-type data transmission, and information delivery by means of push-type data

transmission to the communication devices of clients of the server in the area of the piconet.

Other possibilities include information delivery to the communication
5   devices of clients by broadcast-type data transmission, remote control of PC systems in a piconet, and local connection points to gateway servers, whereby the connections *e.g.* to the Internet network and retrieving information from the Internet network is possible. Further, one could mention a guiding system based on the location of the client in
10   the piconet, whereby the client is guided from one piconet to another. This is based on the small size of the coverage area of the piconet, whereby the location of the client placed in it is known relatively well.

The piconets described above are more suitable than a mobile com-
15   munication network, such as the GSM network, to be used particularly for utilising the precise location of the client *e.g.* in connection with guiding systems or when the network operator offers services dependent on the location of the client. Piconets can be used also when it is desired that the client is not charged for data transmission for using
20   services of the communication network as is usually the case in mobile communication networks. In case of circuit-switched data transmission, the open connection complying with the WAP application protocol usually prevents other communication by the communication device, such as ordinary audio calls, which can be avoided by using piconets.
25
According to an advantageous embodiment of the method of the invention, WAP servers and gateway WAP servers can announce their existence to WAP clients, such as wireless mark-up language (WML) browsers, which are transferred to the area of the piconet where also
30   the WAP server or gateway WAP server is placed. Furthermore, the WAP servers can detect when a WAP client has moved into the area of the piconet, whereby push-type data transmission can be started by the WAP server.

35   According to another advantageous embodiment of the method of the invention, WAP clients can detect different WAP servers in the piconet into whose area the WAP client has moved. Thus, WAP clients operating in also other communication networks, such as a mobile

communication network, can select the piconet as the communication network to be used and select *e.g.* the IR or LPRF data transmission mode. Thus, the communication devices of WAP clients can alternatively use the piconet for data transmission.

5

The method of the invention gives also the advantage of reduced data transmission costs, if the use of services in the piconet is free or the use of services has a very inexpensive charge. Furthermore, the power consumption of the communication devices can be lower in the piconet,

10 because the piconet is typically a communication network with a small transmission output power and consequently a short range.

A further advantage of the method of the invention is that when any of the operations of a device can be remote-controlled, the remote control

15 unit used can be the WAP client comprising means for connection to the piconet. Thus, the remote controlled device comprises means for connecting to the piconet and, further, this device is used as a WAP server in the piconet to make the remote control possible.

20 In the following, the present invention will be described in more detail with reference to the appended drawings, in which

Fig. 1   shows a local area network system applying the method of the invention, in a reduced schematic diagram,

25

Fig. 2a   shows an advantageous embodiment of the hardware applying the method of the invention, in a block chart,

Fig. 2b   shows a peripheral device applying the method of the in-

30   vention, in a reduced block chart,

Fig. 3a   shows data transmission between two communication devices applying the method of the invention, by means of a reduced layer model and a block chart,

35

Fig. 3b   shows the operation of the transport protocol of a communication device applying the method of the invention, in a reduced layer model and a block chart, and

Fig. 4   shows the operation of communication devices applying the
           method of the invention and a local area network, by means
           of a reduced chart on a peripheral device complying with an
5   advantageous embodiment, and

Fig. 5   shows the operation of a communication device applying the
           method of the invention, in a reduced manner by means of a
           layer model and a block chart.
10
           Figure 1 shows a local area network system in a reduced chart. The
           system comprises a communication device, *i.e.* a server device 1, such
           as a mobile station 1, which may comprise for example means 2 for
           setting up a data transmission connection to a mobile communication
15   network 3 and means 4 for setting up a local area network 5 between
           the server device 1 and peripheral devices. The server device 1 used
           can also be a gateway server 401 as shown in Fig. 4, whereby a data
           transmission connection can be set up via this server device 1 *e.g.* by
           means of a cable connection to the Internet network 402. Further, it is
20   obvious that the server device 1, which comprises the means 4 for set-
           ting up the local area network 5, can be a different device than the
           gateway server device 401, which is in that case used as a peripheral
           device in the local area network 5. The server device 1 can be used in
           the local area network 5, *e.g.* in the piconet mentioned earlier, without a
25   connection outside the local area network, whereby it can offer *e.g.* in-
           formation services to the other peripheral devices. Moreover, a periph-
           eral device can also be the above-mentioned mobile station, such as a
           communication device 403 shown in Fig. 4, comprising means 2 for
           setting up a data transmission connection to the mobile communication
30   network 3. Further, it is obvious that the peripheral device used can be
           a mobile station which does not operate outside the local area net-
           work 5, *e.g.* in the mobile communication network 3.

           Peripheral devices in the system of Fig. 1 include a printer 6, a telecop-
35   ier 7, a CDROM reading device 8, a mass memory 9, an auxiliary
           keyboard 10, an auxiliary display device 11, and a wireless audio user
           interface 12 provided *e.g.* with a microphone and an ear piece to be
           used for example during a call instead of the microphone 1a and ear

piece 1b of the mobile station 1 shown in Fig. 2a. As examples, Fig. 1 shows still some other peripheral devices: a video camera 13, a personal computer 14 (Desktop PC) and a portable computer 15 (Laptop PC). In the appended Fig. 1, the printer 6 and telecopier 7 are shown

5 as one device, but they can also be separate devices. It is obvious that the method of the invention is not limited solely to the communication network created by the local area network system presented above, but the invention can be applied also in smaller systems which do not comprise all the peripheral devices 6—15 shown in the system of Fig. 1 or

10 in systems which comprise, for example as shown in Fig. 4, only a server 300b or 400 used as the server 1 and several separate mobile stations 300a, 400 and 403.

Further, with reference to Fig. 1, the mobile station 1, such as a mobile

15 phone, comprises also the means 2 shown in Fig. 2a for setting up a data transmission connection with the mobile communication network 3, means for reading the data on the SIM card of the mobile station and for storing data on the SIM card, a control unit (CU) comprising advantageously a micro controller unit (MCU) and a control logic circuit, such

20 as an application specific integrated circuit (ASIC). Moreover, the control unit is also equipped with a memory, such as a read-only memory (ROM) and a random access memory (RAM). The operation of the mobile station is prior art known as such to a man skilled in the art, wherein its further description will not be necessary in this context.

25

With reference to Fig. 2a, the means 2 of the server device 1 for setting up a data transmission connection with the mobile communication network 3, i.e. a long-distance link module, comprises i.e. in accordance with the GSM mobile communication system known as such, a radio

30 transmitter 2a, a radio receiver 2b, a local oscillator 2c, a modulator, a demodulator, and an antenna circuit 2f. Nevertheless, the invention is not limited solely to the GSM mobile communication system, but the invention can be applied also in other mobile communication systems. The means 4 of the server device 4 for setting up the local area net-

35 work 5, i.e. the short-distance link module, comprises e.g. a transmitter 4a and a receiver 4b, such as a radio transceiver, a local oscillator 4c, a modulator, a demodulator, and an antenna circuit 4f. In the server device 1 shown in Fig. 2a, the controller of the short-distance

10

link module of the server device and the controller of the server device are shown as one CTRL control block 4d, but in practical applications they can also be separate.

5 When the server device 1 is a mobile station, the CTRL control block 4d comprises the above-mentioned control unit CU for controlling the mobile station. The mobile station 1 operating only in the local area network system 5 can be totally without the means 2 for setting up a data transmission connection with the mobile communication network 3.

10

The changes required by the method of the invention in the communication device 1 can be advantageously implemented by changes made in the above-mentioned CTRL block, for example by changes made in its control program.

15

With reference to Fig. 2b, the peripheral devices 6—15 that can be coupled to the local area network are equipped with a corresponding short-distance module 16, by means of which the peripheral device 6— 15 can communicate with the local area network 15, advantageously

20 the server device 1. The short-distance link module 16 of the peripheral device comprises at least a transmitter 16a and a receiver 16b. The short-distance link module 16 comprises further a local oscillator 16c, a modulator, a demodulator, an antenna circuit 16f, and a CTRL control block 16d. An advantageous alternative implementation for the local

25 area network 5 is a short range radio network (SDRF, LPRF), whereby no visual contact or optically reflective contact is required between the server device 1 and the peripheral devices 6—15. Thus, the different peripheral devices 6—15 and the server device 1 can be even in different rooms, on condition that the distance between the server

30 device 1 and the peripheral device 6—15 is within the operating radius of the local area network 5, i.e. the cell. On the basis of the description above, it is also obvious that the peripheral device used can only be a wireless communication device operating in said local area network 5.

35 In the following description, the WAP application protocol described earlier is used as an example of data transmission protocols to illustrate the method according to the invention described here. The WAP clients and WAP servers mentioned in the following description refer advanta-

geously to clients and servers of the communication network applying the WAP application protocol. Naturally, it is obvious that the invention can be applied within the scope of the claims also in connection with another application protocol, whereby the WAP indication mention in
5   this description is used to refer to the use of this application protocol.

With reference to Fig. 4a, the protocol stack of the layer model of an advantageous WAP compatible system (WAP protocol stack) contains the following layers, listed from the top layer downwards:
10   —   a wireless application layer, *i.e.* WAP application layer 301a and 301b, comprising at least a wireless mark-up language browser (WML browser) and a WMLS interpreter, as well as telephony value-added services (TeleVAS services) and possibly other services,
15   —   a wireless session protocol (WSP) 302a and 302b,
     —   a WTLS layer 304a and 304b, and
     —   a wireless transport protocol layer (WTP), *i.e.* WTP transport protocol 303a and 303b.

20   With the layer model, reference is made advantageously to the ISO/OSI layer model for describing different functions. The upper layers of the WAP architecture (wireless application layer, WSP layer, WTLS layer) are independent of the communication network used, but the WTP layer 303a and 303b must be applied on the basis of the par-
25   ticular requirements of the communication method used at the time, *e.g.* the GSM network or the LPRF or IR network. In the WAP application layer 301a and 301b, the architecture of the wireless application environment (WAE) is applied, where the different communication network services are based on the use of the wireless transport protocol (WTP)
30   and the wireless session protocol (WSP), which also creates the general framework for the development of wireless devices, such as mobile phones and PDA devices. Moreover, it should be noticed that the WAP architecture is very flexible, and layers can be replaced by other ones. Changes are necessary for example when the application layer uses
35   another presentation format, such as HTML or JavaScript.

WAE applications follow closely the protocol applied in the Internet World Wide Web network, where applications, services and information

are given in standardised presentation formats which are browsed *e.g.*
by means of known WWW browsers. Thus, the servers and information
of the WWW network are provided with a uniform resource locator
(URL) address complying with the Internet standard and irrespective of
5   location, and the information presentation format is one supported by
the browser, *e.g.* HyperText Markup Language (HTML) or JavaScript.
For browsers to be able to communicate with servers of the communi-
cation network, also standardised data transmission protocols are
needed, the most common of which is the HyperText Transport Proto-
10   col (HTTP) used in the WWW network. Consequently, the WAE archi-
tecture uses URL addressing according to the WWW standard, and
with applications complying with the WAE architecture, it is possible to
use also services of the WWW network simultaneously taking into
particular consideration the special properties of the wireless
15   communication devices and the wireless communication network.

For retrieving information via the communication network, the commu-
nication device needs a WML browser and a HTTP WWW server cou-
pled to the communication network, whereby the browser transmits a
20   request to the selected server for retrieving the desired information,
which is identified with the URL address. This information is given *e.g.*
in the WML language which can be compared with the HTML language.
After obtaining the information, it is possibly subjected to WML/HTML
conversion and presented to the user by means of the application used.
25   Usually, also the URL addresses stored in the URL register of the
communication device can refer to local services, such as TeleVAS
functions of the device itself, or to remote services, such as information
of a server in the WML form. The URL register of the device contains
advantageously a collection of URL addresses of known services.
30
Said TeleVAS services include answering an incoming call, setting up a
call, cutting off a call, and transfer of a call. For example certain Tele-
VAS functions use URL local addresses, which can be *e.g.* in the form
DEVICE://FILE/FUNCTION, and certain TeleVAS functions use URL
35   remote addresses, such as HTTP://TELEVAS.DOMAIN/FILE/FUNC-
TION, for starting services. In the WAP system, for example, a call is
set up by setting up a connection to an HTTP address, and the voice

mail system utilises both local and remote addresses which are similar to those described above.

With reference to Fig. 3a, the requests of WAP applications are
5   transmitted via the WSP layer 302a which assists in the data transmission by the WAP layer 301a and is used as a general base for transferring information between the WAP client 300a and the WAP server 300b, for conducting push-type data transmission initiated by the server 300b or for optimising data transmission. If necessary, the
10   information is secured by the WTLS layer 302a and 304a (Wireless Transport Layer Security), serving the task to offer the facilities for this purpose. The WSP session protocol offers a connection point to the transfer protocols of the upper layers and sets up a mapping between the WAP and the Internet architectures and particularly between the
15   WTP and the Internet transport protocols. Communication between the different layers takes place by means of so-called abstract service primitives which describe information exchange and control between the transport layers 303a and 303b and the adjacent layers in the architecture.
20

The WTP transport protocol of the WAP architecture forms a protocol family for the WTP layer 303a. The WTP layer 303a operates above the data transmission services, offering its services to the upper WSP and WTLS layers 302a and 304a, simultaneously making transparent
25   data transmission possible. The WTP transport protocol comprises a WTP/T protocol which is intended primarily for connection-oriented data transmission, and a WTP/D protocol which is intended primarily for the transfer of datagrams, *i.e.* data packets containing the destination address and the information to be transmitted. The WTP/D (also called
30   WDP, Wireless Datagram Protocol) is a simple transfer protocol which transfers the protocols of the WAP application layers 301a and 301b as well as the packet information in an unchanged, *i.e.* transparent, form from the client 300a to the server 300b, and *vice versa*. The WTP/T is optimised particularly for wireless data transmission services with a
35   limited frequency band. The purpose of WTP protocols is to set up a common connection for different physical transport mechanisms used in different communication networks, which also have different frequency bands. The communication networks can be based on full-

duplex, half-duplex or simplex technologies. It is also a purpose of the WTP protocols to be compatible with the corresponding transport layer of the TCP/IP and UDP transport protocols. Moreover, it is another purpose of the WTP protocols to offer the protocols of a higher level a

5   connection based on the port, *i.e.* connection point, whereby it is possible to take into account the different properties of different devices and their applications.

Further, with reference to Fig. 3a, the nodes, *i.e.* WAP clients, WAP

10   servers and gateway WAP servers can announce their existence in the area of the piconet 5 by registering as services (piconet services) in a piconet protocol stack 305a and 305b. According to an advantageous embodiment, the piconet has the nature of a temporary, *ad hoc* communication network, whereby the nodes are not registered in a certain

15   server used as a base station in the piconet. Thus, registration in the network means that the node monitors communication in the piconet and is ready to reply to inquiries relating to the identifications of its device and services. Thus, also with reference to Fig. 3a, the piconet protocol stack 305a is formed in the device of the client 300a, and the

20   piconet protocol stack 305b is formed in the device of the client 300b. When new nodes are detected in the piconet 5, the WAP servers, such as the server 300b, can inquire if they are used as WAP clients. Also, if WAP clients, such as the client 300a, enters the piconet, they can inquire if the other nodes are used as WAP servers or gateway WAP

25   servers.

According to the presentation above, the piconet protocol stack makes it at least possible that the piconet node announces the services supported by this node and a node in the piconet detects which services

30   are supported at each node of the piconet. In addition, the protocol stack advantageously makes connectionless and connection-oriented data transmission possible between different nodes in the piconet. Advantageously, the piconet makes it possible to transmit information relating to WAP applications by broadcasting. It is a purpose of the

35   piconet to provide WAP nodes in the piconet a so-called pipe, *i.e.* a communication channel. By means of a pipe 306, communication can be started by a node which is the WAP client 300a, or a node which is the WAP server 300b.

Advantageously, the piconet makes possible also service announce-
ments by nodes on the services supported by them. Advantageously,
the devices of the nodes can announce at least if the device has a
5   WAP compatible protocol stack. Advantageously at this stage the
nodes announce if they support operations of the WAP server, the
gateway WAP server and/or the WAP client.

Further, with reference to Fig. 3a, the pipe 306 of the piconet 5 termi-
10   nates at the piconet transport block 306a and 306b of the above-de-
scribed WTP layer 303a, 303b, applying the method of the invention.
The WTP transport protocol makes it possible to register and use sev-
eral data transmission channels in data transmission of WAP applica-
tions. Each data transmission channel is provided with a separate
15   transport block, blocks 306a, 306b, 307 and 308 in Fig. 3a, implement-
ing the functions according to channel specifications. It is an aim of the
WTP transport protocol to offer a uniform interface for the clients above
the same, *i.e.* for example the WTLS layer 304a, the WSP session
protocol 302a and the WAP application layer 301a.
20

With reference to Fig. 3b, the following is a more detailed description
on the operation of the piconet transport (PT) block 306a, 306b apply-
ing the method of the invention. The purpose of the PT block 306a,
306b is the mapping of the different functions of the piconet 5 used for
25   the WTP transport protocol, for example the mapping of transactions
for the connection-based WTP/T service of the WTP transport protocol
and the mapping of datagrams for a connection-based or connection-
less WTP/D service. The PT block 306a, 306b is used as an interface
so that it utilises the method used by the piconet 5 for identifying other
30   devices, such as devices 300a and 300b offering WAP services, in the
piconet 5, and simultaneously conceals this function from the other lay-
ers of the WAP stack. This has the advantage that the piconet 5 can be
connected with the WAP stack by making only slight changes in the
implementation or protocols of the WAP stack, or changes can be to-
35   tally avoided. Even though the signals 322 of the PT block would not
affect the definitions of the WAP application protocol, they still have an
effect on the servers and clients wishing to conduct different automatic
operations when detecting a server or a client.

Further, with reference to Fig. 3b, the PT block 306a, 306b comprises firstly mapping functions 310 and 311 which map WTP services 316 and 317, such as WTP/D and WTP/T, for native services 318 of the pi-

5   conet 5 (WTP/T—Piconet Mapping, WTP/D—Piconet Mapping). Secondly, the piconet control unit (PCU) 312 takes care of the differences in the piconet 5 and the WTP transport protocol, particularly relating to differences in addresses and data service set-ups. Advantageously, the PCU control unit 312 is capable of signalling 322 on transactions relat-

10   ing to the usability of WAP devices 300a and 300b in the piconet 5. Typically, the PCU control unit 312 processes transactions relating to the dynamic properties of the piconet 5. ASP mentioned in Fig. 3b refers *e.g.* to logical protocol operations 313, 314 and 315 (abstract service primitives) which are included also in the upper and lower inter-

15   faces of all layers in the stack and through which the clients, *i.e.* for example the WTLS layer 304a, the WSP session protocol 302a and the WAP application layer 301a, use the services, *i.e.* for example from point to point WTP/T and WTP/D transport services 316, 317 and other transport services 319. In addition to this, ASP operations are included

20   in the upper and lower interfaces of all layers in the stack. Arrows illustrated between the blocks in Fig. 3b indicate the transfer of information between these blocks.

In the following, the operation of said mapping functions 310 and 311

25   will be discussed in an advantageous embodiment of the method of the invention. The quality of service in the piconet corresponds to or is better than the quality of service according to the WTP transport protocol. If the quality of service is better, the WTP/D and WTP/T transport service is only used as a reliable transaction service in connection-

30   based data transmission of the stream data service of the piconet. WTP services are used for connectionless data transmission of the stream data service of the piconet in case broadcast-type data transmission is involved in the area of the piconet. Table 1 presents a summary of the mapping of transport services between WTP services and

35   the services of the piconet.

WTP service	Piconet service
WTP/S Stream Service	Connection-based data service or virtual network
WTP/T Transaction Service	Connection-based data service or virtual network
WTP/D Datagram Service, Point-to-point	Connection-based data service or virtual network
WTP/D Datagram Service, Broadcast	Connectionless data service

Table 1.

In the following, the operation of the above-mentioned PCU control unit 312 will be described. It should be noticed that nodes enter and leave the network continuously, whereby the PCU control unit must take care of the resulting differences between the piconet and communication networks based on a conventional cellular system. In cellular networks, the nodes, *i.e.* mobile stations, are registered in the network and move in the area of different cells continuously, simultaneously maintaining the data transmission connection. The addresses of the nodes of the WAP services are for example MSISDN numbers, IP addresses (Internet Protocol), or X.25 addresses.

The MSISDN number corresponds to a standardised PSTN (public switched telephone network) or ISDN (integrated services data network) number, and it consists of a "+" code, an NDC code (national destination code) and a mobile subscriber specific number. In some cases, the MSISDN number does not indicate a single mobile subscriber but a certain WAP server or gateway WAP server which communicates with a short message switching centre (SMSC). Some other address alternatives are also shown in Table 2.

Data transmission mode	Address
UDP/IP: CDPD, CSD circuit switched data transmission and GPRS	16 bit source and destination port number of UDP header, 32 bit source and destination IP address of IP header
GSM SMS-PP	16 bit source and destination port number of UDH header, source and destination MSISDN number, SMSC address (MSISDN)
UDP: IS-136 GUTS/R-Data	16 bit source and destination port number of UDP header, 4 bit protocol identification of GUTS header with 4 bit message type, 32 bit source and destination IP address of R-Data layer with routing information
X.25	X.25 compatible address

Table 2.

The data of WTP services is transferred via a connectionless or con-
nection-based piconet data service, wherein the address details of the
5   WTP application, such as the port addresses of the WTP service, are
processed and transferred as data. It can be said that different port ad-
dressings of WTP services are multiplexed by means of one connec-
tionless or connection-based data service link between nodes of the pi-
conet, wherein in the WAP application protocol, several communica-
10   tions of different services can take place simultaneously and they are
all channelled into a common piconet pipe.

The addresses used by the piconet for the nodes differ from those used
by the WAP application protocol, wherein it is necessary to map an ad-
15   dress used by the WAP application protocol for a corresponding ad-
dress used by the piconet or a temporary address created by the pi-
conet. When the WAP node moves out from the piconet, the address
used by it no longer refers to this node, wherein e.g. bookmarks of the
WML browser refer to a node that is no longer accessible in the pi-
20   conet. If the node used is a WAP server or a gateway WAP server, the
mapping of the addresses is easy, because these nodes typically have

their individual MSISDN or Internet-based addressed that is used also in the WAP application protocol. Thus, bookmarks referring to these WAP nodes are valid also later on.

5   With reference to Fig. 4, the following is a description on data transmission initiated by a client 300a applying the method of the invention (WAP client) in a piconet 5. When the WAP client 300a enters the coverage area, *i.e.* cell, of the piconet 5 (stage S1), it detects the WAP server 300b (gateway) or servers of the piconet 5. Thus, the PT

10   block 306a of the WAP client 300a inquires the data needed by the WAP application protocol from the network 5, to make data transmission between two WAP systems possible. In the inquiries, functions of the piconet 5 are utilised. The inquired data contain an individual identification (ID) that can be used for identifying the WAP server sys-

15   tem 300b. If the WAP server system 300b has a standardised Internet address, such as a domain name, this address will be used. The application of the WAP client 300a can automatically retrieve the home page of the WAP server 300b to the user of the device of the WAP client 300a, or it confirms a search request from the user. If necessary,

20   the user can select the WAP server to be used, such as 300b and 400, if several servers are available in the piconet 5. The functions depend also on the WAP application used, and the WAP client 300a is not expected to act in any predetermined way, *e.g.* for using services of the WAP applications of the servers 300b and 400. The WAP client 300a

25   can start communication with the WAP server 300b, *e.g.* for retrieving information from the server, because the identification ID or Internet address of this server is available to it. Also the WAP server 300b has at this stage (stage S2) detected the entry of the WAP client 300a in the piconet, whereby it is possible to start for example push-type data

30   transmission services with the WAP server 300b.

When the WAP client 300a leaves (stage S3) the piconet 5, communication between the WAP client 300a and the WAP server 300b or 400 is no longer possible by means of the piconet 5. However, if the WAP

35   server 300b has an Internet address or a MSISDN address, the WAP client 300a can set up a data transmission connection to this server via another piconet or a cellular network, such as a mobile communication network. Thus, it is a requirement that the WAP server 300b is coupled

e.g. to the Internet network 402 and further via the Internet network to said second cellular network or piconet. Another requirement is that the device of the WAP client 300a can communicate with said cellular network, piconet, or both. Advantageously, the client 300a comprises

5   the means, described earlier, for setting up a data transmission connection to the mobile communication network 3, wherein, as shown in Fig. 4, the client 300a can communicate 404 also with the communication device 403, such as a mobile station.

10   Further with reference to Fig. 4, the following is a description on data transmission initiated by a server 300a or 400 (WAP server) applying the method of the invention in a piconet. The piconet WAP clients 401, WAP servers 400 or gateway WAP servers 300b detect the entry of the WAP client 300a in the piconet 5. Thus, the WAP client 300a is in-

15   quired for the data needed by the WAP application protocol, so that communication between two WAP systems is possible. The inquiry is conducted by functions of the piconet 5. The data inquired comprise an individual identification (ID) that can be used for identifying the WAP client system 300a. If the WAP client system 300a has a standardised

20   Internet address, such as a domain name, this address will be used. The application of the WAP server 400 can greet the WAP client 300a entering the piconet 5 *e.g.* by sending the home page, advertisement information, or instructions. It will depend on the application to be used what information is transmitted and how the information is utilised. The

25   functions depend also on the WAP application used, and the WAP server is not expected to act in any predetermined way *e.g.* for setting up a data transmission connection with the WAP client.

When the WAP client 300a leaves the piconet (stage S3), communica-

30   tion between the WAP client 300a and the WAP server 400 or 300b is no longer possible by means of the piconet 5. However, if the WAP client 300a has an individual Internet address or a MSISDN address, the WAP server can set up a data transmission connection with this client via another piconet or cellular network, such as a mobile communica-

35   tion network. Also in this case it is required for example that the WAP server is coupled to the Internet network, such as the WAP server 300b in Fig. 4, and the WAP client 300a is coupled to a cellular network.

In an advantageous embodiment of the method according to the invention, mapping is conducted in the following way. The PCU control unit of the WAP node initiating the data transmission inquires from its host system for service parameter (SP) information. If the attribute information of the service parameters contains address information (320a, 320b), *i.e.* so-called ADR information, the node associates the WAP node with this address information (320a, 320b). The aim is to link ADR information and the original address of the WAP node used by the piconet, *i.e.* the network address.

When the WAP node transmits information through the WTP layer to a system, whose ADR information corresponds to the address information of the transmission, the information is transmitted to the piconet WAP node to which the ADR information is associated or linked. If there is a gateway WAP server node in the piconet, the information can be transmitted to this node to be transmitted outside the piconet, if this is desired by the transmitting PCU control unit.

If address information relating to the SP parameters is not available in the host system of the WAP node, the PCU control unit, in an advantageous embodiment of the method according to the invention, creates a dummy address (DA) reserved for the WAP node on the basis of *e.g.* the name or network address of the host device. It is possible that the node in question does not support Internet and MSISDN addresses. This DA address can be used in the same way as other, real Internet and MSISDN addresses used by WAP browsers. The PCU control unit links the DA address and the network address of the WAP node in question, used by the piconet.

When the WAP node receives information via the piconet, the PCU control unit of the receiving device checks if address mapping should be conducted. If the WAP node used is a gateway WAP node, its WAP protocol stack will check the address data from the information received. If the address data refers outside the piconet and the WAP node, the WAP node is used in a known manner as a gateway and it transmits an inquiry to the Internet, to the address in question.

Next, the service parameters (SP), mentioned earlier, will be discussed. Service parameter information is used in the PCU control unit in connection with address mapping and creating data transmission connections for data services in the piconet. Table 3 shows examples of service parameter formats for the IR communication network. The parameters shown in Table 3 must be modified *e.g.* for LPRF communication networks.

Parameter, class	Attribute	Denotation
"WAP"	"Role"	Server and/or gateway and/or client
"WAP:Client"	"IrLMP:TinyTP:LsapSel"	Dynamic address of the WAP client in the piconet service multiplexer interface (IrLMP)
"WAP:Client"	"Parameters"	Octet sequence that represents all the WAP parameters for client
"WAP:Server"	"IrLMP:TinyTP:LsapSel"	Dynamic address of the WAP client in the piconet service multiplexer interface (IrLMP)
"WAP:Server"	"Parameters"	Octet sequence that represents all the WAP parameters for server
"WAP:Gateway"	"IrLMP:TinyTP:LsapSel"	Dynamic address of the WAP client in the piconet service multiplexer interface (IrLMP)
"WAP:Gateway"	"Parameters"	Octet sequence that represents all the WAP parameters for gateway

Table 3.

Said octet sequence at the bit level can comprise several different parameters, the most important being presented in Table 4. In addition to

the presented parameters relating to mapping, it is possible to use *e.g.* parameters relating to device names.

Identifi-cation, ID	Length, LEN	Value, VAL	Denotation
0x00	variable	OCTETSEQ	Bit 0: WTP/D supported Bit 1..7: Reserved Bit 8: WTP/T: Class I supported Bit 9: WTP/T: Class II supported Bit 10: WTP/T: Class III supported Bit 11: WTP/T: Class IV supported Bit 12..: Reserved
0x10	variable	STRING	MSISDN of the Service Center (*e.g.* SMSC), "+358105051"
0x11	variable	STRING	MSISDN of the WAP node, "+358105051"
0x20	variable	STRING	IP address of the WAP node
0x21	variable	STRING	IP address of the WAP node in the dotted presentation, "127.0.0.1"
0x22	variable	STRING	IP address of the WAP node as domain name, *e.g.* "www.nokia.com"
0x23	variable	STRING	Subnetwork mask, subnetworks indicated by the gateway WAP server and to which access is provided

Table 4.

5   Next, the data service setup (DSS) of the PCU control unit will be discussed. DSS functions are conducted when the WAP node wants to communicate with a WAP host system, in other words, a WAP client with a WAP server, or *vice versa.* When the WAP protocol stack re-

quests the TP block to communicate with the WAP host system, it is a task of the PCU control unit to create a data service between these two nodes of the piconet. In case of the WTP/T or WTP/D service, the nodes can also be closed by the PCU control unit, if data transmission

5   between these nodes does not take place within a predetermined time. In case of the WTP/S service, the data transmission connection is kept continuously open. Because of long set times of timers monitoring the data transmission connection, operation delays in upper layers of the protocol stack are possible, whereby the data transmission connection

10   does not need to be cut off and reset.

The PCU control unit transmits advantageously to the WAP node a signal on different transactions in the network. For instance, upon the entry of a new WAP client in the piconet, a signal is transmitted, equipped

15   with the address data of the new device. When the WAP node is a WAP server, a signal can be used for informing the WAP client about the fact that there is a new WAP server available for the WAP client in the piconet. It is also possible that the PCU control unit transmits a signal relating to the leaving of the WAP node from the piconet. The

20   above-mentioned signal is used as a sign for the WAP node that it must route a data transmission that was running in the piconet and was cut, or start a new data transmission *e.g.* via a mobile communication network.

25   Further, Fig. 5 is a schematic diagram showing the implementation of remote control applications in a reduced schematic diagram, illustrated with the layer model. For implementing these remote control applications, as well as also other applications, as general services via a server, the different remote control applications must be provided with a

30   connection, *i.e.* an interface (WAP application interface). Advantageously, applications in the interface receive information (signals) about detecting new clients, their leaving from the area of the piconet, or other transactions in the network. In this interface, a service can for example change the home page used by the WML browser of the WAP

35   server so that one link is formed by a link to the remote control application, *i.e.* to the remote control page; that is, for example a CDROM terminal installed in the data processor used as the server is being controlled.

The present invention is not limited solely to the examples given above, but it can be modified within the scope of the appended claims. For example, it is obvious that the services used can be *e.g.* information that is referred to by using a URL address, such as time tables or the like, a WAP compatible protocol, or that the communication device can act as a WAP client or a WAP server. Similarly, information relating to services or address information, to be transmitted to other communication devices, can contain *e.g.* above-mentioned information, a URL address, or a reference to a memory space.

Claims:

1. A method for setting up a data transmission connection which is formed for transmitting information between at least a first communica-
5   tion device (1, 6—15, 300a, 300b, 400, 401) and a second communication device (1, 6—15, 300a, 300b, 400, 401), in which method:

—   for at least the first communication device (1, 6—15, 300a, 300b, 400, 401), a network address (321a, 321b) is selected
10   that is advantageously used for identifying the first communication device (1, 6—15, 300a, 300b, 400, 401),

characterised in that:

15 —   for at least one service of at least the first communication device (1, 6—15, 300a, 300b, 400, 401), an address information (320a, 320b) is formed, which is advantageously used for identifying the service, and

—   that between the network address (321a, 321b) of the first
20   communication device (1, 6—15, 300a, 300b, 400, 401) and the address information (320a, 320b) of the service, a correspondence is arranged for transferring information between the first communication device (1, 6—15, 300a, 300b, 400, 401) and the second communication device (1, 6—15,
25   300a, 300b, 400, 401).

2. A method according to claim 1, **characterised** in that information on the network address (321a, 321b) of the first communication device (1, 6—15, 300a, 300b, 400, 401) and advantageously also on the
30 service is transmitted from the first communication device (1, 6—15, 300a, 300b, 400, 401) to at least the second communication device (1, 6—15, 300a, 300b, 400, 401).

3. A method according to claim 1 or 2, **characterised** in that infor-
35 mation on the services of the second communication device (1, 6—15, 300a, 300b, 400, 401) is transmitted to the first communication device (1, 6—15, 300a, 300b, 400, 401) on the basis of the network address

(321a, 321b) of the first communication device (1, 6—15, 300a, 300b, 400, 401).

4. A method according to any of the claims 1 to 3, **characterised** in that at least the second communication means (1, 6—15, 300a, 300b, 400, 401) is equipped with means (305a, 305b, 306a, 306b, 310, 311, 312) for forming the network address (321a, 321b) and arranging said correspondence.

5. A method according to any of the claims 1 to 4, **characterised** in that the network address (321a, 321b) is formed by utilising the address information (320a, 320b), name, identification code, unique identification code, reserved name, temporary name, standardised address, temporary address of the communication device (1, 6—15, 300a, 300b, 400, 401) or a service, or another network address of the data transmission connection, or the like.

6. A method according to any of the claims 1 to 5, **characterised** in that for setting up the data transmission connection, a short-range radio network, infrared network, inductive network, or the like is used, and that the communication device (1, 6—15, 300a, 300b, 400, 401) used is a mobile station.

7. A method according to any of the claims 1 to 6, **characterised** in that from the first communication device (1, 6—15, 300a, 300b, 400, 401), a second data transmission connection is set up to a communication network (3, 5, 402) for transmitting information between said communication network (3, 5, 402) and the second communication device (1, 6—15, 300a, 300b, 400, 401).

8. A method according to any of the claims 1 to 7, **characterised** in that between the first communication device (1, 6—15, 300a, 300b, 400, 401) and the second communication device (1, 6—15, 300a, 300b, 400, 401), also a second data transmission connection is formed for continuing the transmission of information by utilising this second data transmission connection, and that this second data transmission connection is implemented advantageously by means of a mobile communication network (3).

9. A method according to any of the claims 1 to 8, **characterised** in that the address information (320a, 320b) is advantageously a URL address or an address referring to a memory space.

5

10. A method according to any of the claims 1 to 9, **characterised** in that advantageously several data transmission connections between the first communication device (1, 6—15, 300a, 300b, 400, 401) and the second communication device (1, 6—15, 300a, 300b, 400, 401) are

10   multiplexed in a common communication channel (306) to be formed.

11. A communication device, which first communication device (1, 6—15, 300a, 300b, 400, 401) comprises:

15   —   means (1a, 1b, 2, 2a, 2b, 2c, 2f, 4, 4a, 4b, 4c, 4d, 4f, 16, 16a, 16b, 16c, 16d, 300a, 300b, 305a, 305b, 306a, 306b) for setting up a data transmission connection and for transmitting information between the first communication device (1, 6—15, 300a, 300b, 400, 401) and at least a sec-

20   ond communication device (1, 6—15, 300a, 300b, 400, 401), and

—   means (300a, 300b, 305a, 305b, 306a, 306b) for selecting a network address (321a, 321b), which network address (321a, 321b) is advantageously arranged to identify said

25   first communication device (1, 6—15, 300a, 300b, 400, 401),

characterised in that the first communication device (1, 6—15, 300a, 300b, 400, 401) comprises further:

30
—   means (300a, 300b, 305a, 305b, 306a, 306b) for generating address information (320a, 320b) for a service, the address information (320a, 320b) being advantageously arranged to identify said service,

35   —   means (305a, 305b, 306a, 306b, 310, 311, 312) for arranging a correspondence between the network address (321a, 321b) and the address information (320a, 320b).

12. A communication device according to claim 11, **characterised** in that the first communication device (1, 6—15, 300a, 300b, 400, 401) comprises further:

5   —   means (1a, 1b, 2, 2a, 2b, 2c, 2f, 4, 4a, 4b, 4c, 4d, 4f, 16, 16a, 16b, 16c, 16d, 300a, 300b, 305a, 305b, 306a, 306b) for transmitting information relating to the network address (321a, 321b) of the first communication device (1, 6—15, 300a, 300b, 400, 401) and advantageously also information

10   relating to services or the address information (320a, 320b) to at least a second communication device (1, 6—15, 300a, 300b, 400, 401), and

    —   means (1a, 1b, 2, 2a, 2b, 2c, 2f, 4, 4a, 4b, 4c, 4d, 4f, 16, 16a, 16b, 16c, 16d, 300a, 300b, 305a, 305b, 306a, 306b)

15   for receiving information relating to services or the address information (320a, 320b) of the first communication device (1, 6—15, 300a, 300b, 400, 401) and advantageously also information relating to the network address (321a, 321b).

20   13. A communication device according to claim 11 or 12, **characterised** in that the first communication device (1, 6—15, 300a, 300b, 400, 401) comprises further means (300a, 300b, 305a, 305b, 306a, 306b) for generating a network address (321a, 321b) by utilising the address information (320a, 320b), name, identification code, unique identifica-

25   tion code, reserved name, temporary name, standardised address, temporary address of the communication device (1, 6—15, 300a, 300b, 400, 401) or a service, or another network address of the data transmission connection, or the like.

30   14. A communication according to any of the claims 11 to 13, **characterised** in that the first communication device (1, 6—15, 300a, 300b, 400, 401) is arranged to operate in a short-range radio network, infrared network, inductive network, or the like, and that the first communication device (1, 6—15, 300a, 300b, 400, 401) is arranged to operate

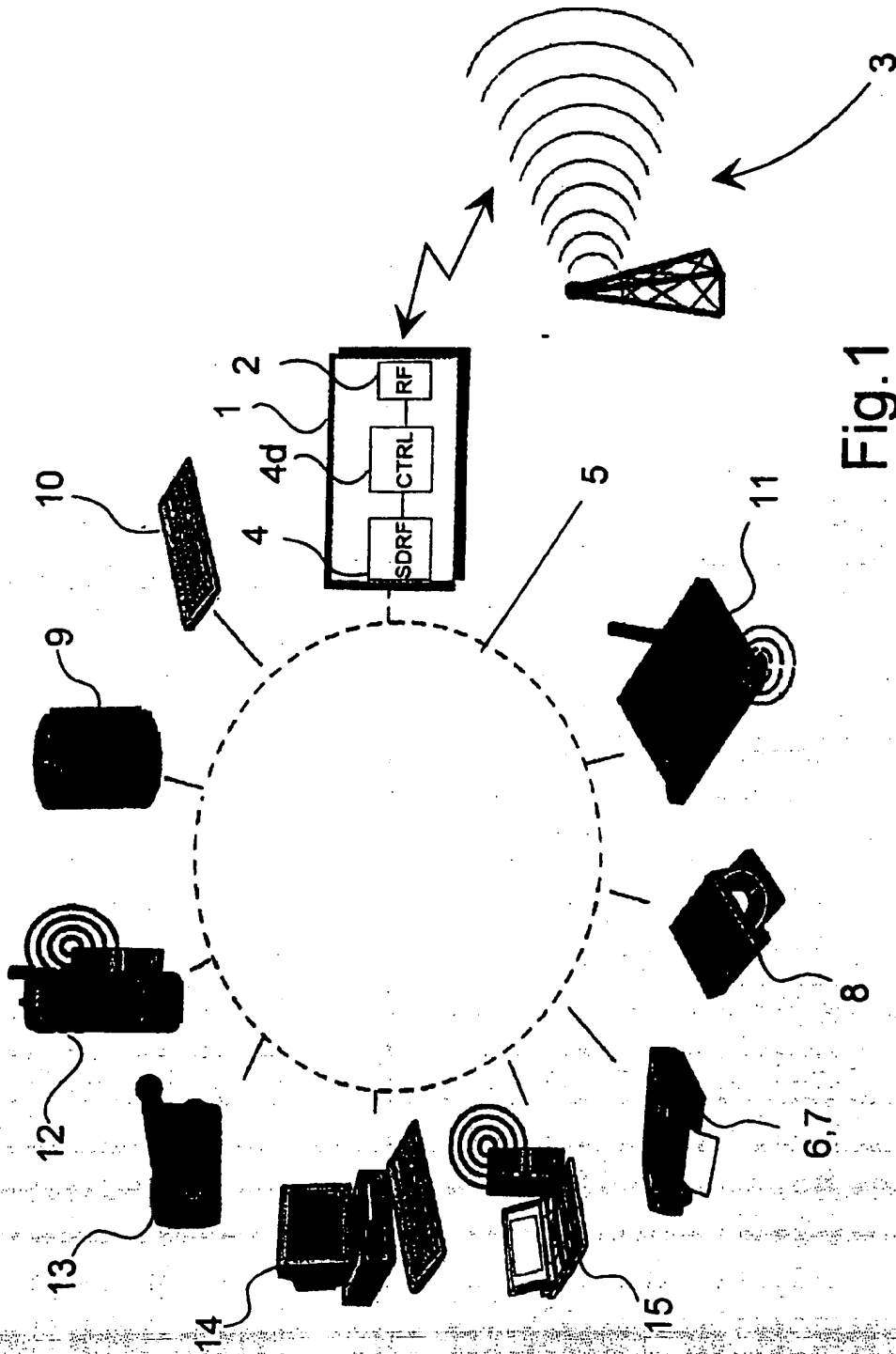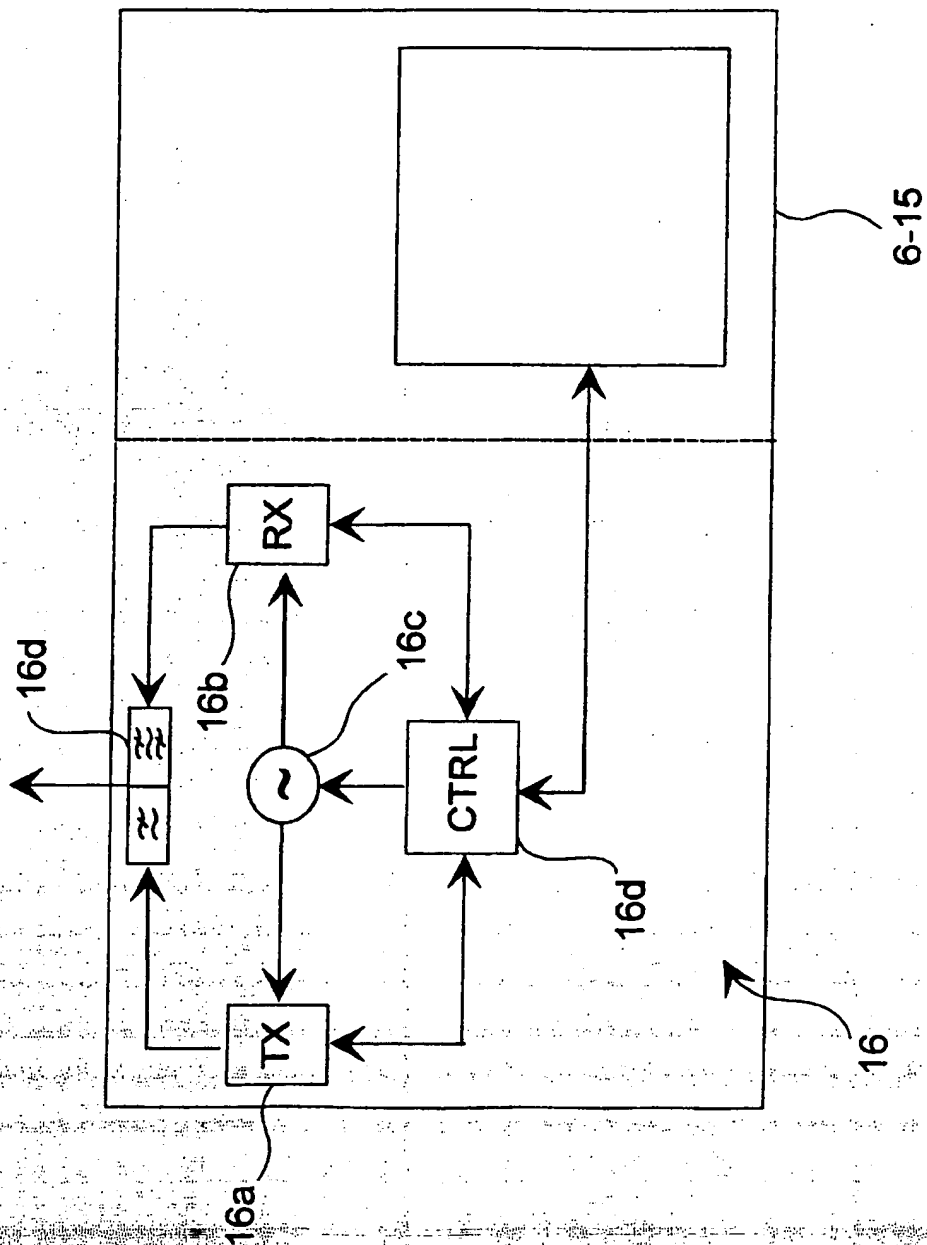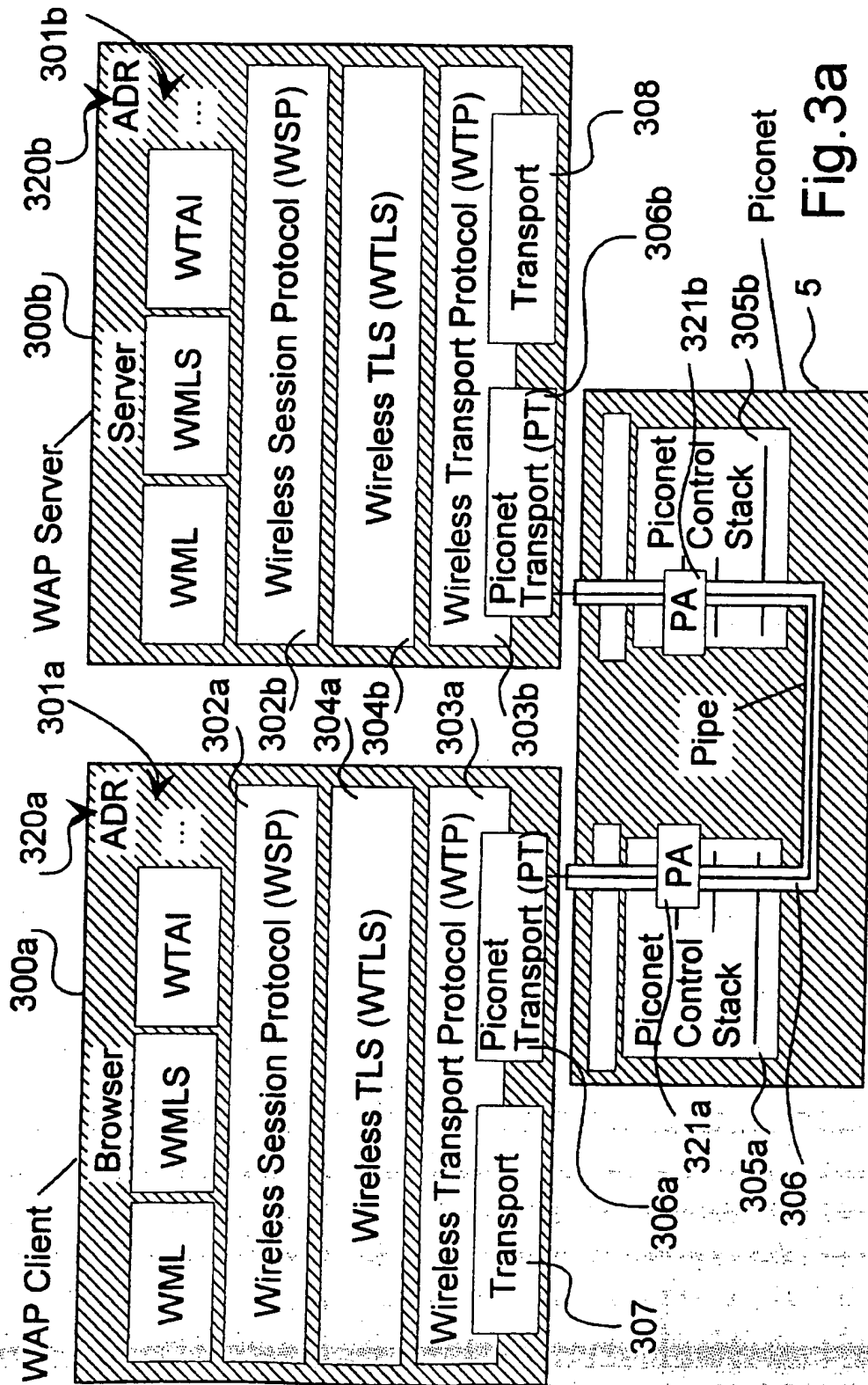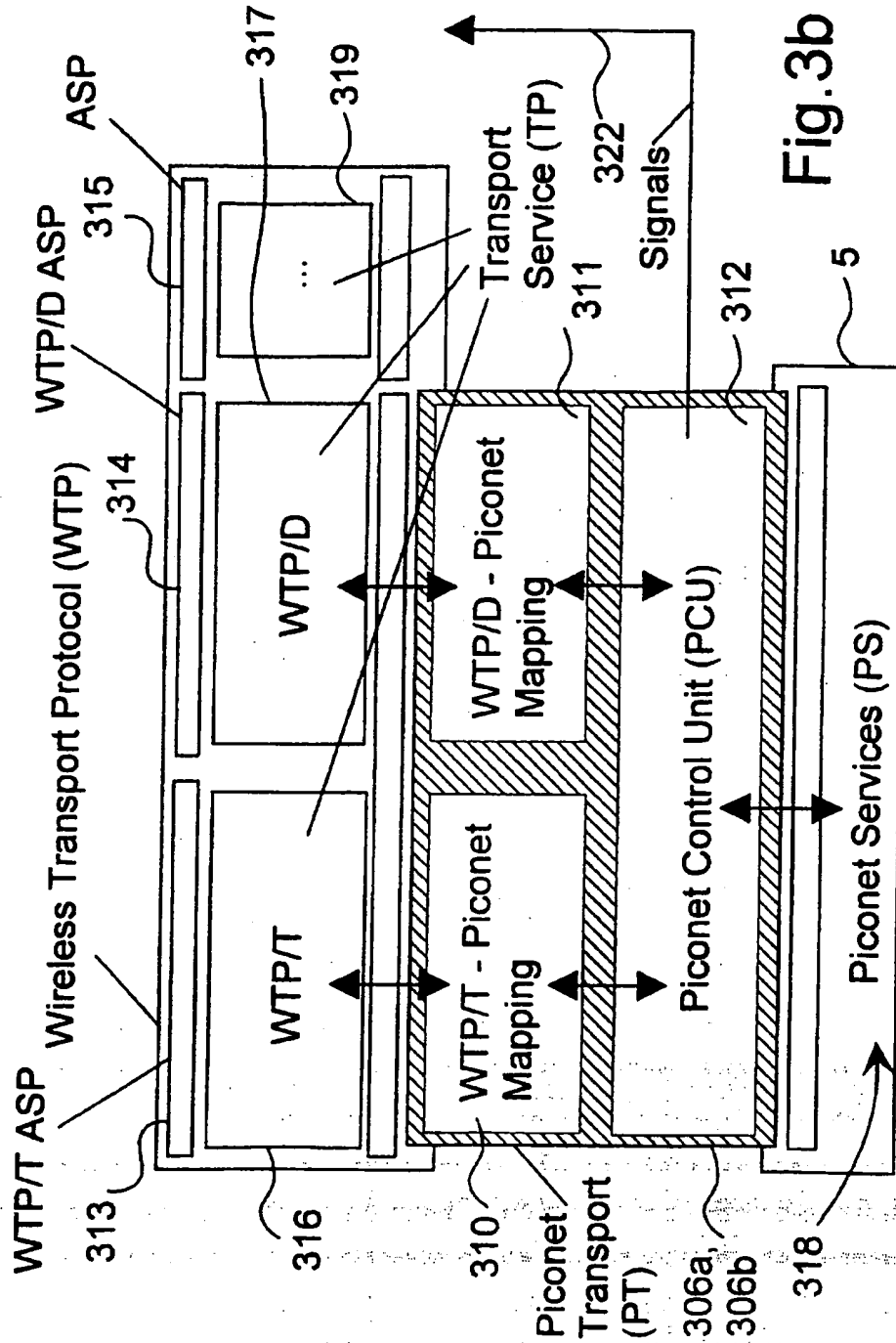35   advantageously also in a mobile communication network (3).

Fig.1

Fig. 2a

Fig. 2b

Fig.3a

WAP Client — 300a
Browser — 301a
ADR — 320a

WML | WMLS | WTAI
Wireless Session Protocol (WSP) — 302a
Wireless TLS (WTLS) — 304a
Wireless Transport Protocol (WTP) — 303a
Piconet Transport (PT) — 303b
Transport — 307

WAP Server — 300b
Server — 301b
ADR — 320b

WML | WMLS | WTAI
Wireless Session Protocol (WSP) — 302b
Wireless TLS (WTLS) — 304b
Wireless Transport Protocol (WTP)
Piconet Transport (PT)
Transport — 308

PA — 306a, 321a
Piconet Control Stack — 305a, 306

PA — 306b, 321b
Piconet Control Stack — 305b

Pipe

Piconet — 5

Fig.3b

Fig.4

Fig. 5

- 49 -

13.   The method of claim 11 wherein identifying
the plurality of records of the first database is
performed at the second computer.

14.   The method of claim 1 further comprising:
5   determining whether the records of the first
database have been changed or added since the previous
synchronization, based on data reflecting whether the
records of the first database have been added or changed
since a previous synchronization;
10   if one of the records of the first database has
not been changed or added since the previous
synchronization, performing a synchronization with
records of the second database using a record
representative of the one record at the time of a
15 previous synchronization, the representative record being
stored in a history file containing records reflecting
the contents of records of the first database at the time
of a previous synchronization.

15.   The method of claim 14 wherein the history
20 file contains at least one record representative of at
least one record of the first database failing to fit the
selected criterion at the time of the previous
synchronization and failing to be synchronized with the
records of the second database at the time of the
25 previous synchronization.

16.   The method of claim 1 further comprising:
        deleting a second plurality of the records of the
first database failing to fit the selected criterion.

17.   The method of claim 16 further comprising:

- 50 -

updating a plurality of records of the second
database failing to fit the current value of the selected
criterion.

18.   The method of claim 1 wherein the selected
5   criterion has a current value during a current
synchronization being different from a previous value
during a previous synchronization, further comprising:
updating a plurality of records of the second
database, based on results of the synchronization,
10   wherein the plurality of records of the second database
fit the previous value of the selected criterion but fail
to fit the current value of the selected criterion.

19.   The method of claim 1 further comprising
synchronizing a third database with one of the first and
15   second databases.

20.   The method of claim 19 wherein synchronizing
the third database with one of the first and second
databases includes:
identifying a plurality of records of a third
20   database fitting a second selected criterion; and
synchronizing at least one of the identified
records of the third database with a second record of the
one of the first and second databases.

21. The method of claim 20 wherein the first-
25   mentioned selected criteria and the second selected
criteria are the same.

22.   The method of claim 20 wherein the second
record of the one of the first and second databases
includes a code identifying the second record as having
30   originated from the third database.

        23.   A computer program, resident on a computer
readable medium, for synchronizing at least a first and a
second database, comprising instructions for :
        identifying a plurality of records of the first
5 database fitting a selected criterion; and
        synchronizing at least one of the identified
records of the first database with a record of the second
database.

        24.   The computer program of claim 23 wherein
10 records representative of the records of the first and
second databases during a prior synchronization are
stored in a history file, and wherein synchronizing the
at least one of the identified records of the first
database with a record of the second database further
15 includes using the history file.

        25.   The computer program of claim 23 further
comprising instructions for identifying records of the
first database based on a selected criterion, wherein
synchronizing the at least one of the identified records
20 of the first database with a record of the second
database further includes synchronizing the at least one
of the identified records of the first database with at
least one of the identified records the second database.

        26.   The computer program of claim 23 wherein
25 synchronizing the at least one of the identified records
of the first database includes adding, modifying, or
deleting the at least one of the identified records of
the first database.

- 52 -

27. The computer program of claim 23 wherein
records of the first database include a text field and
the selected criterion includes a text criterion, and
identifying the plurality records of the first database
5 includes comparing the text field with the text
criterion.

28. The computer program of claim 23 wherein
records of the first database include a number field and
the selected criterion includes a number criterion, and
10 identifying the plurality records of the first database
includes comparing the number field with the number
criterion.

29. The computer program of claim 23 wherein
records of the first database include a date field and
15 the selected criterion includes a date criterion, and
identifying the plurality records of the first database
includes comparing the date field with the date
criterion.

30. The computer program of claim 23 wherein
20 records of the first database include a boolean field and
the selected criterion includes a boolean criterion, and
identifying the plurality records of the first database
includes comparing the boolean field with the boolean
criterion.

25   31. The computer program of claim 23 wherein
records of the first database include a time field and
the selected criterion includes a time criterion, and
identifying the plurality records of the first database
includes comparing the time field with the time
30 criterion.

- 53 -

32. The computer program of claim 23 wherein a
selected plurality of the fields of the records of the
first database are mapped onto a selected plurality of
corresponding fields of the records of the second

5   database and identifying a plurality of records of the
first database fitting a selected criterion includes
determining whether contents of a field of the records of
the first database fit the selected criterion, wherein
the field of the records of the first database is not

10 mapped onto a corresponding field of the records of
second database.

33. The computer program of claim 20 wherein the
first database is located on a first computer and the
second database located on a second computer, the

15 computer program further comprising instructions for:
determining, at the first computer, whether a
record of the first database has been changed or added
since a previous synchronization, using a first history
file located on the first computer comprising records

20 representative of records of the first database at the
completion of the previous synchronization;
if the record of the first database has not been
changed or added since the previous synchronization,
sending from the first computer to the second computer

25 information which the second computer uses to identify
the record of the first database to be unchanged.

34. The computer program of claim 33 wherein
identifying the plurality of records of the first
database is performed at the first computer.

30   35. The computer program of claim 33 wherein
identifying the plurality of records of the first
database is performed at the second computer.

- 54 -

36. The computer program of claim 23 further
comprising instructions for:

    determining whether the records of the first
database have been changed or added since the previous
5 synchronization, based on data reflecting whether the
records of the first database have been added or changed
since a previous synchronization;

    if one of the records of the first database has
not been changed or added since the previous
10 synchronization, performing a synchronization with
records of the second database using a record
representative of the one record at the time of a
previous synchronization, the representative record being
stored in a history file containing records reflecting
15 the contents of records of the databases at the time of a
previous synchronization.

37. The computer program of claim 36 wherein the
history file contains at least one record representative
of at least one record of the first database failing to
20 fit the selected criterion at the time of the previous
synchronization and failing to be synchronized with the
records of the second database at the time of the
previous synchronization.

38. The computer program of claim 23 further
25 comprising instructions for:

    deleting a second plurality of the records of the
first database failing to fit the selected criterion.

39. The computer program of claim 38 further
comprising instructions for:
30   updating a plurality of records of the second
database failing to fit the current value of the selected
criterion.

- 55 -

40. The computer program of claim 23 wherein the selected criterion has a current value during a current synchronization being different from a previous value during a previous synchronization, further comprising
5   instructions for:
    updating a plurality of records of the second database, based on results of the synchronization, wherein the plurality of records of the second database fit the previous value of the selected criterion but fail
10 to fit the current value of the selected criterion.

41. The computer program of claim 23 further comprising instructions for synchronizing a third database with one of the first and second databases.

42. The computer program of claim 41 wherein
15 synchronizing the third database with one of the first and second databases includes instructions for:
    identifying a plurality of records of a third database fitting a second selected criterion; and
    synchronizing at least one of the identified
20 records of the third database with a second record of the one of the first and second databases.

43. The method of claim 42 wherein the first-mentioned selected criteria and the second selected criteria are the same.

25   44. The computer program of claim 42 wherein the second record of the second database includes a code identifying the second record of the second database as having originated from the third database.

- 56 -

45. A computer implemented method of
synchronizing at least a first and a second database, the
method comprising:
         displaying a record selection criteria input
5   region on a computer display for a user to input a record
selection criteria, and
         synchronizing, at a synchronization program, the
first database with the second database using the record
selection criteria.

10   46. The method of claim 45 further comprising:
         transmitting the record selection criteria to a
database manager, wherein the database manager manages
the first database,
         selecting, at the database manager, records of the
15 first database fitting the record selection criteria, and
         transmitting the selected records to the
synchronization program.

         47. The method of claim 45 further comprising:
         selecting, at the synchronization program, records
20 of the first database fitting the record selection
criteria.

         48. A computer program, resident on a computer
readable medium, for synchronizing at least a first and a
second database, comprising instructions for:
25   displaying a record selection criteria input
region on a computer display for a user to input a record
selection criteria, and
         synchronizing the first database with the second
database using the record selection criteria.

- 57 -

49. The synchronization program of claim 48
further comprising instructions for:
        transmitting the record selection criteria to a
database manager, wherein the database manager manages
5 the first database, selects records of the first database
fitting the record selection criteria, and transmits the
selected records to the synchronization program.

50.   The synchronization program of claim 48
further comprising instructions for:
10   selecting records of the first database fitting
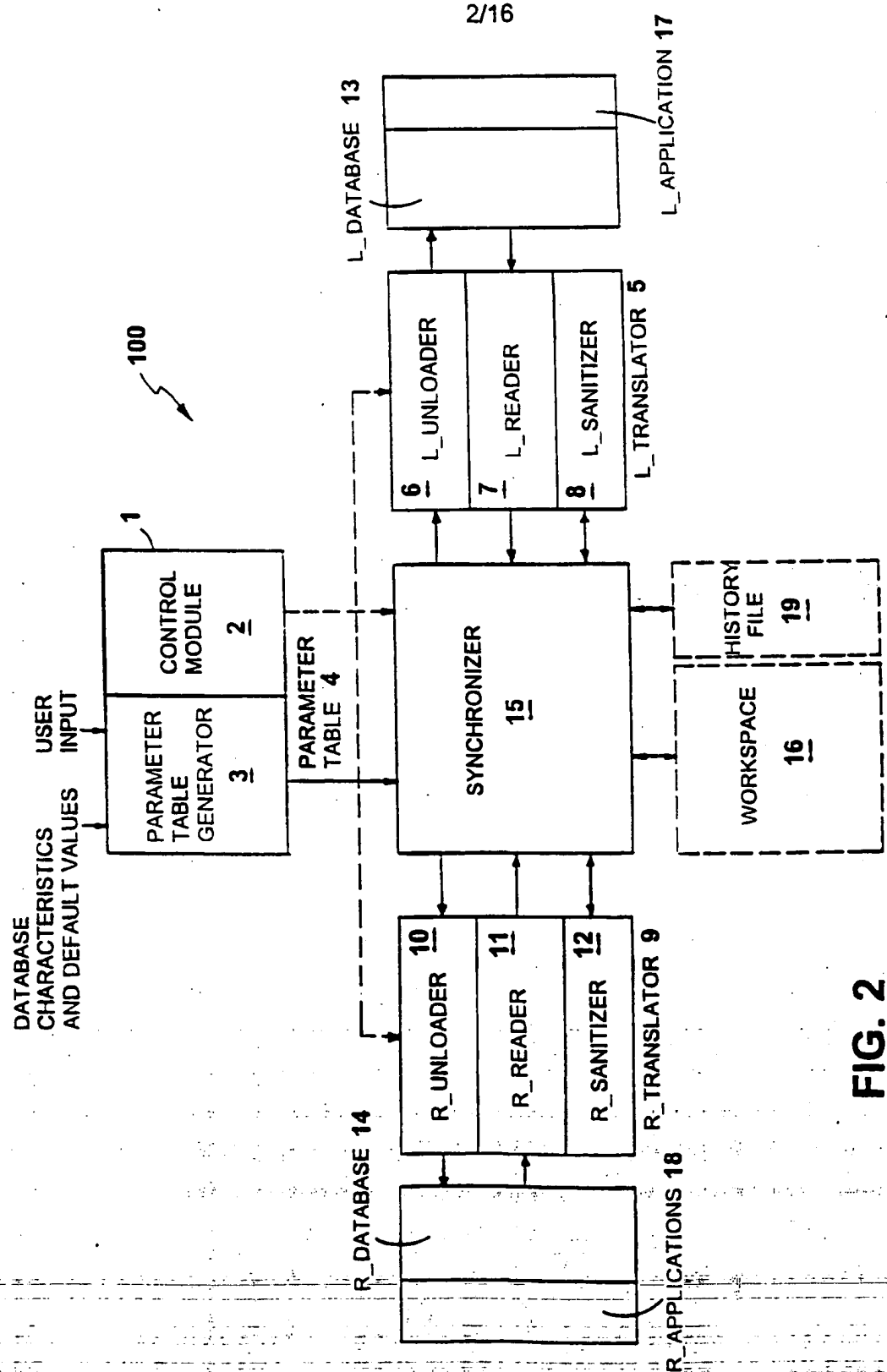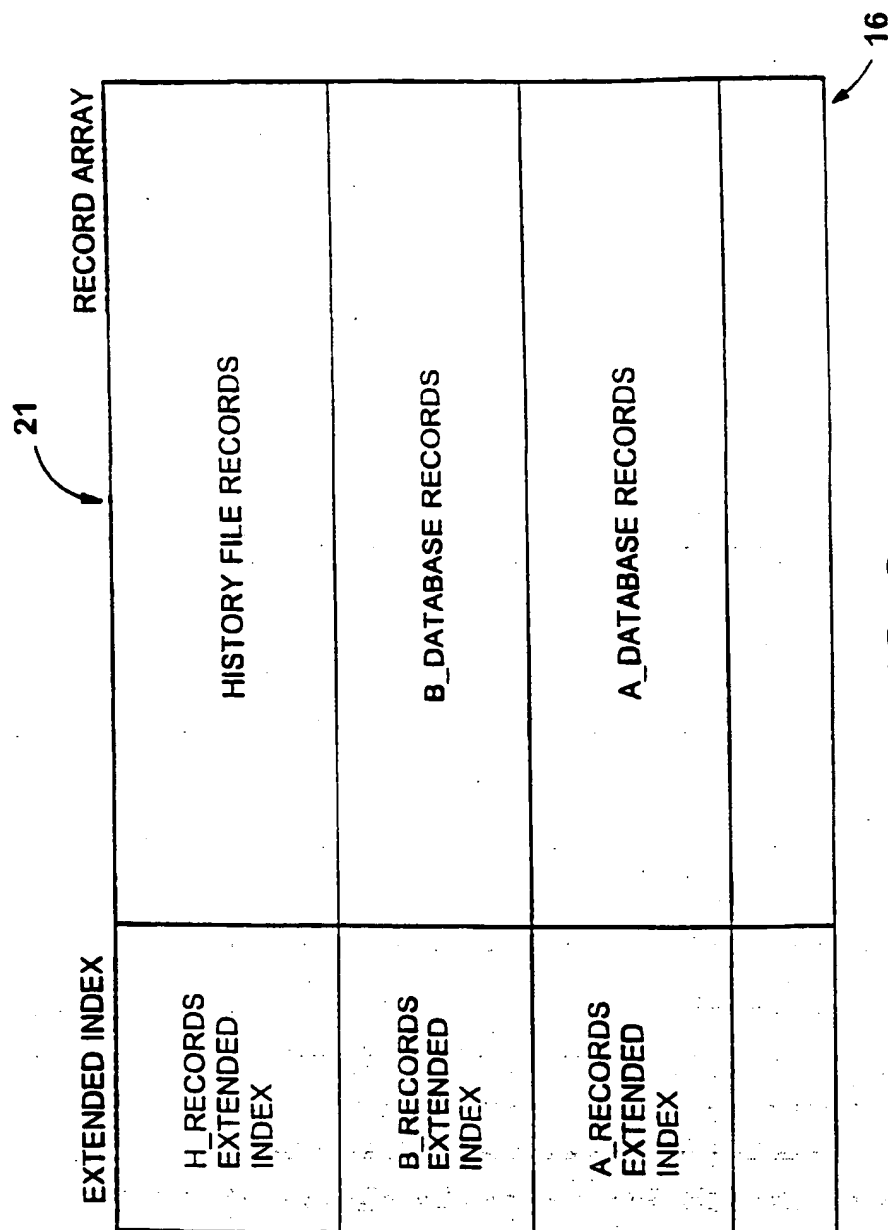the record selection criteria.

FIG. 1

FIG. 2

BNSDOCID: <WO___9945484A1_I_>

FIG. 3
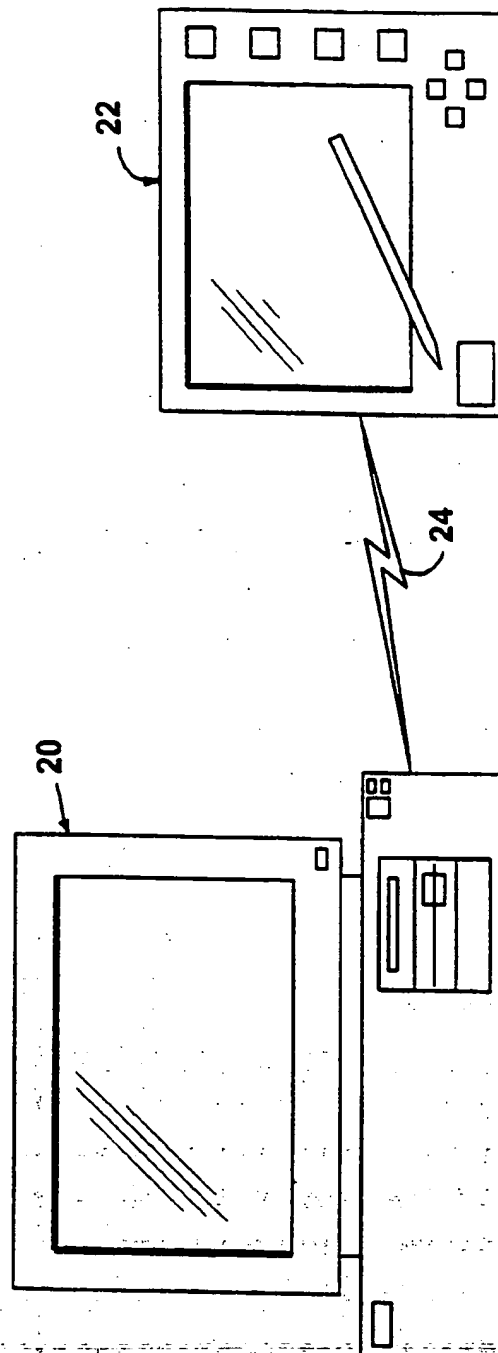
Pseudo Code for Translation Engine Control Module

100.   INSTRUCT parameter table generator to create parameter table and initialize filter
101.   INSTRUCT Synchronizer to initialize itself
102.   INSTRUCT Synchronizer to LOAD the History_File into its WORKSPACE
103.   INSTRUCT R_Translator to LOAD R_records from R_Database
104.   INSTRUCT L_Translator to SANITIZE R_records that were just LOADED
105.   INSTRUCT L_Translator to LOAD L_Records from L_Database and SEND to Synchronizer
106.   INSTRUCT R_Translator to SANITIZE L_Records that were just LOADED.
107.   INSTRUCT Synchronizer to do CAAR (Conflict Analysis And Resolution) on all the records in
       WORKSPACE.
108.   INFORM user exactly what steps Synchronizer proposes to take (i.e. Adding, Changing, and Deleting
       records). WAIT for User.
109.   IF User inputs NO, then ABORT.
110.   INSTRUCT R_Translator to UNLOAD all applicable records to R_Database.
111.   INSTRUCT L_Translator to UNLOAD all applicable records to L_Database.
112.   INSTRUCT Synchronizer to CREATE a new History File.

FIG. 4

5/16

Pseudocode for Generating Parameter Table

{Get Input from the user}

150. ASK user to select whether to use a filter expression
151. IF the user selected to use a filter THEN
152. IF a new filter to be used THEN
153. Obtain from the user filter name
154. Obtain filter expression
155. STORE the current date and time in the FILTER_CHANGED_TIMESTAMP parameter
156. Assign a unique filter ID to the filter
157. ELSE Obtain from the user filter name
158. retrieve the filter expression and unique filter ID
159. IF user selects to edit the filter THEN display the filter and obtain edits
160. SET FILTER_ID parameter to unique filter ID code of the selected filter
161. SET USE_FILTER flag
162. PARSE the filter expression into a filter token array
163. END IF
164. CREATE parameter table

FIG. 5

40

44

Advanced Settings for Phone Records

Conflict Resolution　Filters

You may restrict the scope of this operation by applying a filter to MS Schedule+7.0 (chosen from the list below). Use the buttons on the right to create, edit or delete MS Schedule+7.0 filters.

MS Schedule+7.0 Contacts Filters

○ <None Selected>

○ sched_contacts_1

New...

Edit...

Delete

OK　　Cancel　　Apply　　Help　　Field Mapping

42

FIG. 6

7/16

Filter Name   ☒

Enter a new filter name for MS Schedule+7.0-
Contacts section

sched_contacts_2

OK   Cancel

50

FIG. 7

MS Schedule+ 7.0 filter - sched_contacts_2

Conditions | Rules

Add a new filter condition to the list or Update the currently selected filter condition (highlighted in the list box below). Only items passing the coditions below will be transferred.

66a

Field ▼   66c Operator: 66d   Value: 66e

Last Name   starts with   ▶   M

66b

Add to List   Remove   Update

66f

List of Filter Conditions:

[Last Name] starts with 'M'

OK   Cancel   Help

66g

FIG. 8

FIG. 9

MS Schedule+ 7.0 filter - sched_contacts_2

Conditions   Rules

Select the rule for combining the conditions. You can either specify that all conditions must be
met in order for an item to be transferred, or that at least one of the conditions must pass.

◉ All conditions must be met
○ One or more conditions must be met

List of Filter Conditions:

[Last Name] starts with 'M'

OK   Cancel   Help

Filter language specification

Expression = Condition1 [AND Condition2] ... [OR Condition3] ...

Condition = ARG1 OP ARG2

OP = OP_SET_1 | OP_SET_2 | OP_SET_3 | OP_SET_4 | OP_SET_5 | OP_SET_6

OP_SET_1 = EQ | LE | GE | NE | LT | GT

OP_SET_2 = OP_SET_1 TODAY - | OP_SET_1 TODAY +

OP_SET_3 = OP_SET_1 NOW - | OP_SET_1 NOW +

OP_SET_4 = STARTS_WITH | CONTAINS | DOES_NOT_CONTAIN | IS_EMPTY |
*   IS_NOT_EMPTY*

*OP_SET_5 = + | - | * | / | %*

OP_SET_6 = IS

For Dates - ARG1 OP ARG2:

[Date Fieldname]	*OP_SET_1*	*'YYYYMMDD'	[Date Fieldname2]	TODAY*
[Date Fieldname]	*OP_SET_2*	*integer*

For Times - ARG1 OP ARG2

[Time Fieldname]	*OP_SET_1*	*'HHMM'	[Time Fieldname2]	NOW*
[Time Fieldname]	*OP_SET_3*	*integer*

For TextStrings - ARG1 OP ARG2

[String Fieldname]	*OP_SET_1*	*'textstring'	[String Fieldname2]*
[String Fieldname]	*OP_SET_4*	*'textstring'*

For Booleans - ARG1 OP ARG2

[Boolean Fieldname]	*OP_SET_6*	*TRUE*
[Boolean Fieldname]	*OP_SET_6*	*FALSE*

For Numbers - ARG1 OP ARG2

[Number Fieldname]	*OP_SET_1*	*integer	float*
[Number Fieldname]	*OP_SET_5*	*integer	float*

FIG. 10

200.   FOR each Record in history file
201.   Load record
202.   Write record to Workspace
203.   Next

FIG. 11

300. IF Use_Filter = TRUE and R_Application_Is_Filtering = FALSE THEN
301.   FOR each Record in the remote database
302.   Load record
303.   Filter the loaded record
304.   IF record passes the filter THEN mark as PASSED_FILTER
305.   ELSE mark as FAILED_FILTER
306.   Send record to synchronizer
307.   In Synchronizer: Write record to Workspace
308.   Next
309. ELSE IF Use_Filer = TRUE and R_Application_Is_Filtering = TRUE THEN
310.   Send the filter expression to R_Application
311.   Load filtered records
312.   IF the record passes current filter THEN Mark as PASSED_FILTER ELSE Mark as
      FAILED_FILTER
313.   Send records to synchronizer
314.   In Synchronizer: Write records to Workspace
315. END IF

FIG. 12

350. Form all records in the workspace into CIGs
351. For each CIG
352.   Compare the records in CIG
353.   Determine synchronization outcome
354.   IF a synchronization outcome is a conflict THEN
355.   IF one of the database records in the CIG does not pass the current filter, THEN skip CIG and mark results as DO NOT UPDATE any of the records
356.   ELSE resolve conflict by reference to a user-selected rule or input from the user
357.   END IF
358.   IF the most up to date record fails the filter, THEN mark all records as having failed the current filter
359.   IF the filter expressions contains an unmapped field and one of the database records in the CIG are marked as having failed the filter, THEN mark all records as having failed the filter
360.   IF a fanned out recurring record is partially outside of the current filter, THEN mark the record to be fanned when being unloaded and delete previous fanned nonrecurring records
361. Next

FIG. 13

400. FOR each remote database record
401. IF Use_Filter = TRUE and the filter is a static filter THEN
402. IF record is marked as FAILED_FILTER THEN
403. Delete record on the remote database
404. Else IF the record is marked as PASSED_FILTER THEN add, delete, or modify record according to results of synchronization obtained during CAAR analysis
405. ELSE IF Use_Filter = TRUE and the filter is a dynamic filter THEN
406. IF record fails the current filter THEN
407. Delete record on the remote database
408. Else IF the record passes the current filter THEN add, delete, or modify record according to results of synchronization obtained during CAAR analysis
409. END IF
410. Next

FIG. 14

450. FOR each local database record
451.   IF Use_Filter = TRUE and the filter is a static filter THEN
452.   IF record is marked as FAILED_FILTER THEN
453.   IF CAAR outcome is to modify the record then modify the record on the local database
454.   Else IF the record is marked as PASSED_FILTER THEN add, delete, or modify record according to results of synchronization obtained during CAAR analysis
455. ELSE IF Use_Filter = TRUE and the filter is a dynamic filter THEN
456.   IF record fails the current filter but marked as PASSED_FILTER THEN
457.   IF CAAR outcome is to modify the record then modify the record on the local database
458.   Else IF the record passes the current filter THEN add, delete, or modify record according to results of synchronization obtained during CAAR analysis
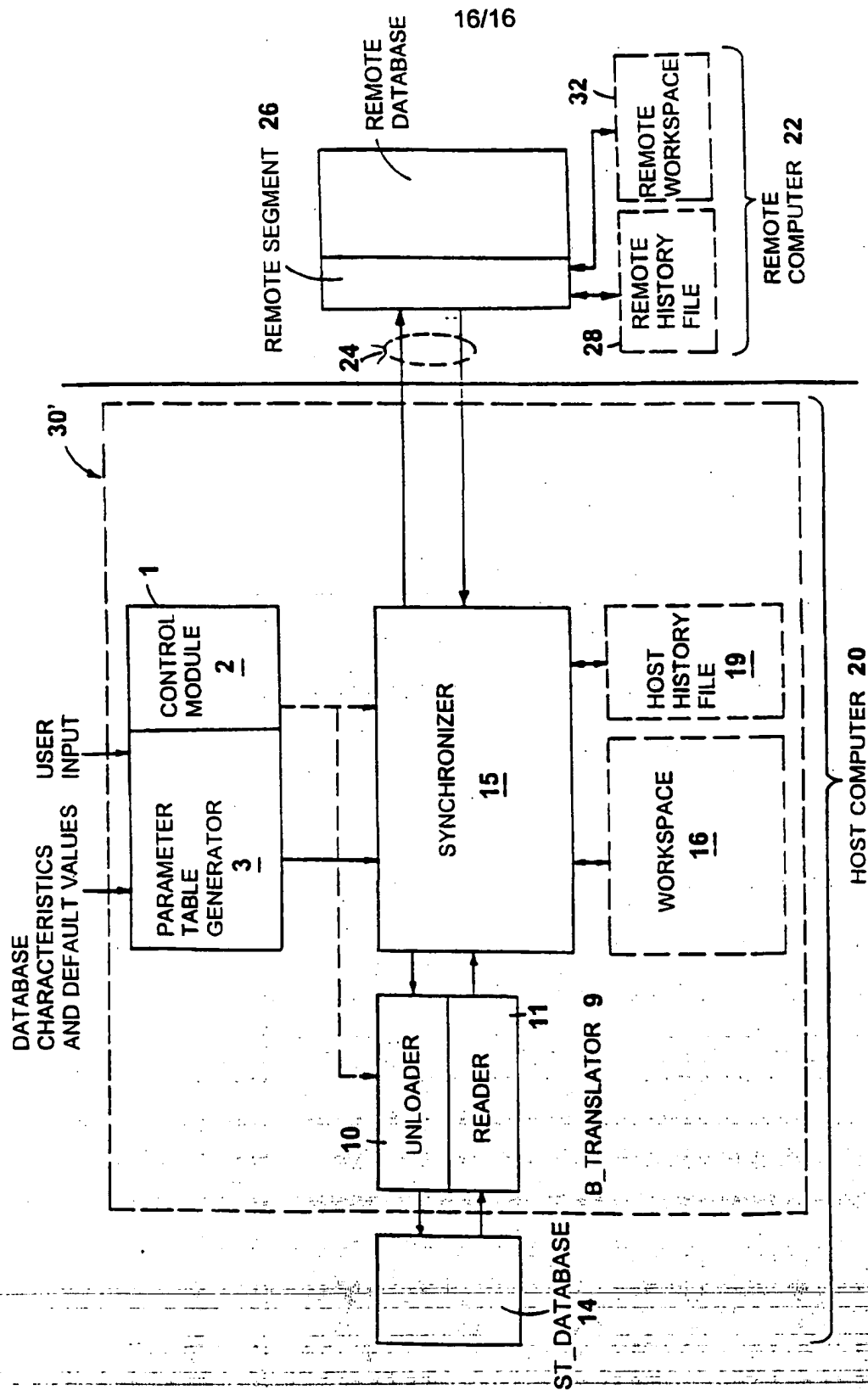459.   END IF
460. Next

FIG. 15

FIG. 16

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6)   :G06F 17/30

US CL   : 707/201,202,204;395/182.04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. :   707/201,202,204;395/182.04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,170,480 A (MOHAN et al.) 8 December 1992, Col 1, line 54 - Col 2, line 22; Col 10, line 11 -40	1-50
X	US 5,261,045 A (SCULLY et al.) 9 November 1993, Col 1, line 26 - Col 3, line 17.	1,3-5,16-17,23,25-27,38-40,48-50
X	US 5,327,555 A (ANDERSON) 5 July 1994,, Abstract, Figure 2, Col 1, line 6 - Col 2, line 8; Col 6, line 48 - Col, 8, line 27.	1-50
X	US 5.600,834 A (HOWARD) 4 February 1997, Abstract, Col 1, line 17 - Col 4, line 26.	1-50

| X | Further documents are listed in the continuation of Box C. | | See patent family annex. |

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"O"	document referring to an oral disclosure, use, exhibition or other means		
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Date of the actual completion of the international search	Date of mailing of the international search report
26 JUNE 1999	1 6 AUG 1999

Name and mailing address of the ISA/US	Authorized officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	PAUL R. LINTZ PH.D.
Facsimile No. (703) 305-3230	Telephone No. (703) 305-3832

Form PCT/ISA/210 (second sheet)(July 1992)*

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,684,990 A (BOOTHBY) 4 November 1997, Abstract, Figure 3, Col 1, line 33 - Col 4, line 5.	1-50
X	US 5,710,922 A (ALLEY et al.) 20 January 1998, Abstract, Col 2, line 4 - Col 3, line 20; Col 17, line 65 - Col 18, line 61.	1-50

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